

Rupture of the major bronchi following closed injury to the chest

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ABSTRACT : Rupture of the major bronchi following closed injury to the chest is comparatively rare. However, an increasing incidence of this condition is to be expected as the number of automobile accidents continued to rise.

During the past 25 years we have had experiences with the management of four cases of traumatic rupture of the bronchus due to non-penetrating trauma. These cases are described here.

CASE REPORTS

Case 1.

A fifteen-year-old boy was admitted on Nov. 13, 1963. He had been in an automobile accident and received injuries of the head and right chest. He was in mild shock and breathing with considerable difficulty and stridor were noted. Roentgenologic examination disclosed a right pneumothorax. The mediastinum and the heart were shifted to the left. An intercostal catheter was inserted in the right pleural cavity for decompression purposes. However, a continuous stream of air issued from the intercostal tube (Fig. 1). A presumptive diagnosis of ruptured bronchus was made. A thoracotomy was immediately performed through a right posterolateral approach. Pneumothorax under tension was noted on opening pleura. The upper lobe was so damaged by severe contusions that an upper lobectomy was performed. Dissection of the hilum disclosed a complete division of the right main bronchus. End-to-end anastomosis of the ruptured main bronchus was carried out with interrupted silk sutures. Inflation of the

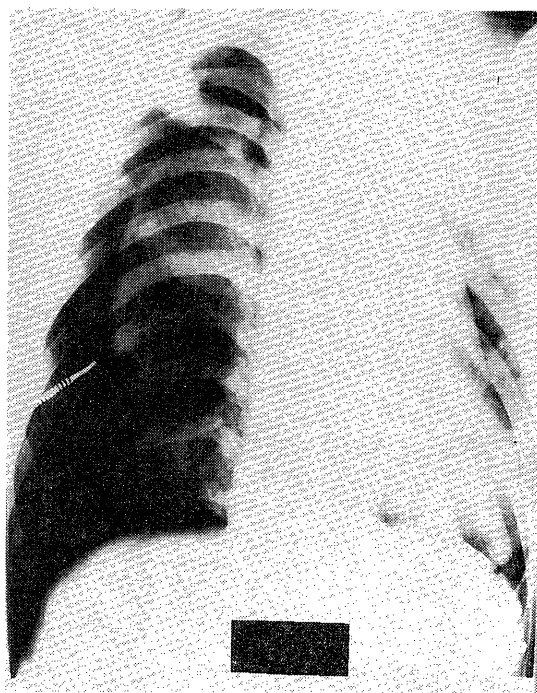


Fig. 1. Chest roentgenogram of a 15-year-old boy with complete avulsion of the right main bronchus demonstrates tension pneumothorax despite decompression with intercostal chest tube

lung showed prompt and satisfactory reexpansion of the middle and lower lobes. Bronchoscopy performed on the fourteenth day after operation showed a patent anastomosis with a small granulation tissue at the suture line, which was removed by biopsy forceps. The patient recovered well and was discharged from the hospital on December 21, 1963.

Case 2.

A forty-nine-year-old man was admitted on May 4, 1979. One month previously he was crushed his chest by conveyer and he was transferred to a local hospital. He complained of dyspnea and left side chest pain. Cyanosis and subcutaneous emphysema were remarkable. X-rays of the chest revealed hemopneumothorax in the left side with rib fractures. A catheter was placed in the left chest and attached to an under-water suction. He recovered gradually and the chest tube was removed five days after insertion. On April 16, he suddenly complained of dyspnea. Roentgenogram of his chest showed complete atelectasis of the left lung with displacement of mediastinum to the left (Fig. 2). Left thoracotomy was performed on April 27 and disclosed the complete disruption of the left main bronchus. The chest was closed without further manipulation and he was transferred to our hospital. On admission the patient was breathless on exertion. The left hemithorax was narrower than the right and was moved only slightly on breathing, without any breath sounds. Bronchoscopic examinations disclosed complete obstruction of the left main bronchus. On May 11, 1979, a left thoracotomy was performed through the 6th intercostal space. The left lung was completely atelectatic, with considerable adhesions in the pleural space. The left main bronchus was covered with dense fibrous tissue and occluded. Bronchial anastomosis of the ruptured left main bronchus was considerably difficult because of the long gap between proximal and distal end of the disrupted left main bronchus. Then, a left pneumonectomy was performed. He was discharged from the hospital on May 28, 1979. He is now complaining of dyspnea on exertion and is in the local hospital.

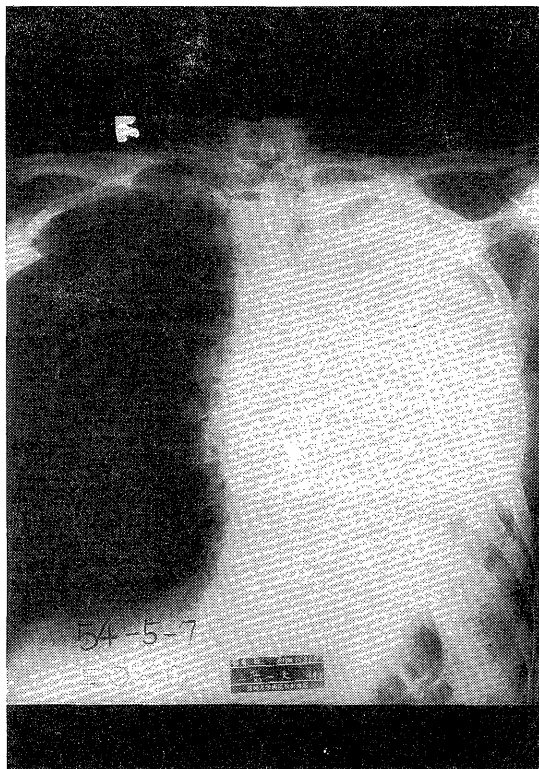


Fig. 2. Chest roentgenogram of a 49-year-old man with complete collapse of the left lung sixteen days after blunt chest trauma.

Case 3.

A 5-year-old boy was admitted to the hospital as an emergency case after falling from the fifth floor of an apartment. He was unconscious on admission and extremely dyspneic. Cyanosis was prominent and subcutaneous emphysema was noticed on his anterior chest and back. The breath sounds over the both sides of the thorax were greatly decreased. A roentgenogram demonstrated large pneumothorax on both sides of the thorax and mediastinal emphysema was also observed. Immediately after admission, chest tubes were inserted into both pleural spaces. The child was connected to the respirator. There was full expansion of both lungs after insertion of the chest tubes. On the next day after admission, atelectasis of the right upper lobe has occurred (Fig. 3). However, the leakage of air continued on the following day.

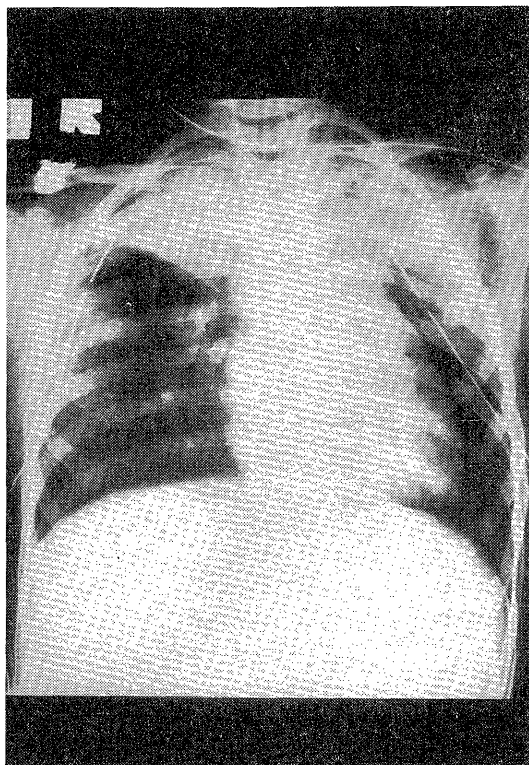


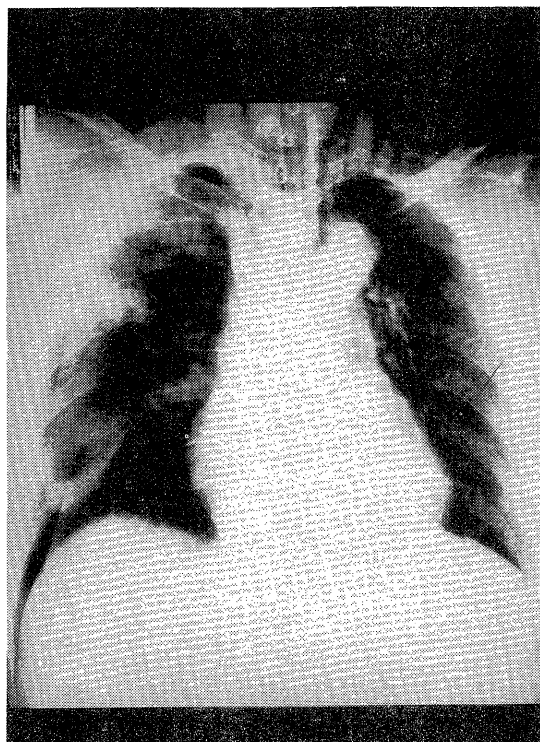
Fig. 3. Chest roentgenogram of a 5-year-old boy with complete transection of the right upper bronchus shows atelectasis of the right upper lobe next day after injury.

A preliminary bronchoscopic examination, performed on the 4th day after injury, suggested that rupture of the right upper bronchus had occurred. Then thoracotomy was performed. The right pleural space was entered through the fifth intercostal space and right middle and lower lobes were inflated well. The hilar region was exposed and complete rupture of the right upper lobe bronchus was demonstrated at the point of its origin. Further examination revealed the complete rupture of the cartilaginous portion with an intact membranous portion of the intermediate bronchus. Shredded bits of the bronchial wall were trimmed from each end of the severed bronchus. End-to-end bronchial anastomosis was carried out with continuous and interrupted 3-0 Dexon sutures, first, the intermediate bronchus and next, the upper lobe bronchus. The site of anastomosis was covered with the

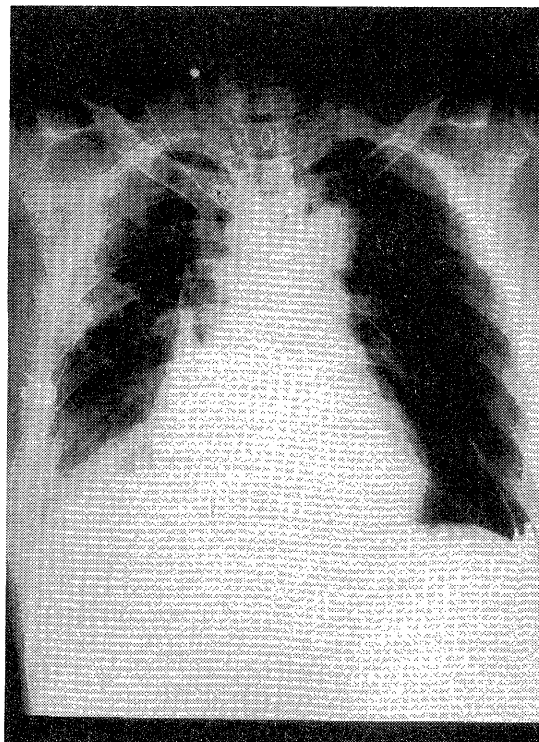
pleura. Inflation of the lung showed prompt and satisfactory reexpansion of the right lung. No leakage of the air was present. On the day after operation, atelectasis of the right upper lobe was noted in the chest x-ray. Bronchoscopic aspiration of the sputum was performed, but no improvement was obtained. Then rethoracotomy was performed three days after the first operation. The three Dexon sutures at anastomosis of the right upper bronchus were removed and the anastomotic region was examined which revealed that thick sputum was retained in the upper lobe and segmental bronchi. Aspiration of intrabronchial secretions was done and reinflation of the upper lobe was gained. To inflate the upper lobe and aspirate intrabronchial secretions postoperatively, small-lumen catheter was introduced through the neck to the upper lobe bronchus percutaneously. Then, reanastomosis of the right upper bronchus was performed. The patient recovered well after rethoracotomy and the chest x-ray taken two years after operation showed full expansion of the right lung. He is healthy and plays with his friends without handicap 7 years after operation.

Case 4.

The patient was a 58-year-old woman, who was collapsed down because of squeezing her chest between the block wall and the car. She was brought to the hospital and complained of dyspnea and bloody sputums. The chest x-ray on admission showed haemopneumothorax in the right side and pneumomediastinum (Fig.4). The chest tube was inserted into the right thorax and her symptoms were improved. However, she complained of dyspnea 6 days after admission and chest x-ray revealed atelectatic changes of the right middle and lower lobes. The bronchoscopic examination was performed and the rupture of the right main bronchus was diagnosed. Then, thoracotomy was done at the seventh day after injury. On opening the pleura, the right lung was inflated well and the mediastinal pleura was seen edematous and it was incised. The right main bronchus was completely separated at the point distal to the tracheal carina. The



A)



B)

Fig. 4. A) Chest roentgenogram of a 58-year-old women with complete disruption of the right main bronchus. Note the cervical and mediastinal emphysema and right haemopneumothorax. B) Chest roentgenogram 6 days after injury. Note the atelectasis of the right middle and lower lobes.

both ends of the disrupted bronchus were anastomosed with interrupted 3-0 vicryls after debridement of each edge. Her postoperative course was uneventful. Her chest x-ray 3 months after operation revealed that the right lung was reflatated completely, and the bronchoscopic findings at the same time showed no stenosis in the area of sutured line. She is well and has no respiratory symptoms 4 years after operation.

COMMENT

Rupture of major bronchi due to closed chest injury has remained relatively uncommon, but there has been a steady increase in the reported cases^{1) 2)}.

Early diagnosis and management of traumatic major bronchial disruptions are necessary.

Dyspnea, hemoptysis, and respiratory distress progressively increase and clinically subcutaneous emphysema is almost always observed in the patients with rupture of major bronchi. Presence of tension pneumothorax or hemothorax and mediastinal emphysema in the chest x-ray are the suspicious findings of this type of injury. Almost continuous flow of air from the intercostal chest tube, observed in our first patient, characterizes the early symptomatology.

Affected lung not only collapsed because of the pneumothorax but also dropped inferiorly because of loss of anchoring support, this roentgenologic sign is diagnostic of bronchial separation³⁾. Atelectasis occurring after thoracic injury, particularly with a history of pneumothorax or hemoptysis, which was observed in our third patient and fourth patient

was noted in this type of injury.

Bronchoscopic examination was particularly useful in blunt chest injuries and confirmed the diagnosis and localized the tear¹⁾.

However, BIRINGER⁴⁾ mentioned that diagnosis of ruptured major bronchi following non-penetrating chest trauma is by no means easy, even with bronchoscopy. The disrupted bronchus may be covered by neighbouring tissues or hematoma and sealed off. This phenomenon constitutes the patent air way and the aerated peripheral lung.

The mechanism of bronchial rupture in closed injury to the chest must be related to a sudden increase of intratracheobronchial pressure against a closed glottis with a simultaneous regional strain or shear upon the bronchial cartilage, bringing about its rupture⁵⁾. The point most likely to tear appears to be the main bronchus at or within a few centimeters of the carina.

Kinsella and Johnsrud⁶⁾ reviewed the literatures and found 38 cases of traumatic rupture of the bronchus. None of these were surgically repaired. Nineteen patients died within three days after injury. If rupture of the major bronchi after blunt chest trauma is not diagnosed, atelectasis of the affected lung occurs due to scar formation of disrupted portion of bronchus. Then progressive dyspnea or pulmonary infection occurs in the patients.

If diagnosis of disrupted major bronchi is made and the condition of the patient is stable, immediate thoracotomy should be performed. Repair of the ruptured bronchus offers immediate improvement and rapid recovery of the patient. The disrupted bronchial stumps must be carefully trimmed to provide clean undamaged tissues.

NONOYAMA *et al*⁷⁾ reviewed the literatures and found that 3 patients had repair of bronchial rupture more than five years after injury. A 16-year-old boy who underwent repair fifteen years after bronchial disruption was reported by Paul SAMSON⁸⁾.

If infection had been superimposed on the atelectatic lung, the lung could not be expanded because of fibrosis and cystic change due to secondary pulmonary infections⁹⁾. Pneumonectomy may be necessary, as observed in

our second patient.

There were several reports that multiple bronchial ruptures might occur, as observed in our third patient (5-year-old boy) and thorough examinations of the uni-lateral lung is mandatory during operation. Three of 4 our patients who were performed reconstructive surgery recovered and returned to normal activity. However, the patient who did not have bronchoplasty, complained of dyspnea on exertion and is in the hospital now. This result emphasizes the importance of early recognition of the bronchial disruption after blunt chest trauma and prompt repair of ruptured bronchi.

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